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Technical Report 5-21776 Contract No. DAAH01-01-C-R160 Delivery Order No. 005b

# A Research and Analysis of AMCOM, RDEC, ED, Production Engineering Division and the Systems Engineering Effort

(5-21776)

Final Technical Report for Period 6 June 2001 through 30 September 2001

February 2002

Prepared by:

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Prepared for:

U.S. Army Aviation & Missile Command Redstone Arsenal, AL 35898 Attn.: Ms. Patti Martin

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#### **PREFACE**

This technical report was prepared by the faculty of the Industrial and Systems Engineering and Engineering Management Department at the University of Alabama in Huntsville. The purpose of this report is to provide documentation of the work performed and results obtained under Delivery Order 005b of AMCOM Contract No. DAAH01-01-C-R160. Dr. Dawn R. Utley was the principal investigator. Ms. Patti Martin, Production Engineering Division, Engineering Directorate, Missile Research, Development and Engineering Center, provided technical guidance.

The views, opinions, and/or findings contained in this report are those of the author and should not be construed as an official Department of the Army position, policy, or decision unless so designated by other official documentation.

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Prepared for: Commander

U.S. Army Aviation & Missile Command

Redstone Arsenal, AL 35898

I have reviewed this report, dated <u>February 2002</u>, and the report contains no classified information.

Principal Investigator

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#### 1.0 Introduction

The Engineering Directorate (ED) of the Aviation and Missile Research Development and Engineering Center (AMRDEC) provides systems engineering support to AMCOM aviation and missile weapons system project offices. This systems engineering function includes the areas of quality and production engineering.

The Directorate has seen many changes over the past five years in the merging of Aviations and Missile Commands and mergers between groups within the Directorate. The Directorate provides support to its customers in the areas of systems, quality, reliability, and production. As such, expert and updated knowledge in these technical areas and in engineering management principles is needed to facilitate the understanding and dissemination of this knowledge for the successfully accomplishment of the Directorate's goals.

#### 2.0 Objective

The objective of this task is to provide expertise in the areas of strategic planning, systems engineering, and facilitating effective communication techniques. This task shall include aiding in the development of a strategic plan for the future of PE, assessing current capabilities and identifying future needs. Evaluation of the systems engineering effort within ED will be assessed according to established standards and procedures. And specific recommendations will be made.

#### 3.0 Statement of Work

The statement of work, as outlined in delivery order 005b, was as follows:

- 3.1 Strategic Planning. The contractor shall investigate background information to assess the current of the Directorate and specifically PE. Such things as mission and vision statements review, internal and external environment assessment, and future needs of customers and the supporting Directorate will be used to help establish a strategic plan for PE specifically. Interviews with key AMCOM personnel and a possible survey developed and administered to assess the skill level and mix within PE will be used as part of the assessment.
- 3.2 Systems Survey results from a previous endeavor will be used to map requirements to independent standards such as EAI and CMMI. Benchmarking of other government facilities offering similar support as ED along with the analysis mapping will be used to identify strengths and weaknesses within the Directorate Development of specific recommendations will result from this study.

3.3 Seminar meetings will be conducted for the purpose of sharing information with the employees of PE. This information is intended to be timely and could include training in effective engineering management principals such as communication techniques. It might also include summary and recommendations of improvement efforts within the Directorate.

#### 4.0 Conclusion and Recommendations

During the time frame allocated by the delivery order, the researcher, with the cooperation of representatives from AMCOM Engineering Directorate, conducted research and analysis into the strengths and weaknesses of the Production Engineering Division (PED). Future customer opportunities were identified and competitor threats were assessed. The current strategic mission and vision was evaluated. As a result, a Skills Inventory List was generated to aid in developing a training/education program. This list would also be valuable for new employee orientation to be used to identify expertise and knowledge within PED.

A systems survey was developed with the help of key Systems Engineers within PED on a previous contract. The Carnegie-Mellon Capability Maturity Model Integration was loosely incorporated into the survey. The survey was distributed throughout PED and beyond to other organizations within ED that participated in the systems engineering mission. A formal report detailing the weaknesses and strengths of the systems engineering effort and where in the organization those strengths and weaknesses resided was developed and submitted. This included an assessment with respect to the CMMI.

A meeting was held as part of the staff meeting to dissiminate information about the strategic endeavor and solicite suggestions and concerns. A breakfast meeting was held at which Dr. Componation from UAH gave a brief overview of Produciblity Engineering. Other short informative seminars have been discussed and will be scheduled as soon as time within the division permits.

# **Production Engineering Skills Inventory List**

Please indicate your level of expertise with each of these concepts			Current	Assessme	nt	Have
and tools, then indicate your formal training. The object is to evaluate		None	Some	Moderate	Very	Had Formal
current capabilities within PED and develop strategies for the future.			Exposure	Experience	Proficient	Training
Cond	cepts					
	acility Design and Layout					
	roducibility Engineering					
	esign for Manufacturing					
	laterials Science					
	isk Management					
_	ptimization					
	lodeling and Simulation					
_	roject Management					
	roject Scheduling					
	tatement of Work Devolpment					
	ost Analysis (Engineering Economy)					
	tatistical Process Control					
	apability Maturity Model Standard					
	SO 9000 Standard					
	ariability Reduction					
	Vriting Performance Specifications/Requirements					
_	roduction Readiness Assessments					
	onfiguration Management					
	ov't Acquisition Process					
	ov't Contract Administration/Requirements					
	echnical Readiness Assessment					
22 Ū	Inderstanding of PED Philosophy					
	usiness Process Reengineering					
24 T	heory of Constraints					
_	roduct Planning					
26 P	rocess Planning					
27 A	cquisition Strategy Devolpment					
_						
		_	_		I	
			1	Use or Pro		Had Formal Training
		None	Some	Moderate	Very High	rraining
Self	Management Skills				,	
28 C	communication facilitator with customer		<u></u>		<b></b>	
29 C	Communication facilitator across divisions				ļ	
	Communication facilitator across PED					
31 T	Inderstanding of capabilities within other divisions					
	îme management				<u> </u>	
33 S	Strategic view (futuristic vision)					
34 0	Organization skills (documenting accomplishments)					

		Frequency of Use or Proficiency				Had Formal
		None	Some	Moderate	Very High	Training
Sel	If Management Skills (cont.)					
35	Leadership skills (experience as a team lead or manager)			1		
36	Marketing PED services					
37	Conflict resolution management					· · · · · · · · · · · · · · · · · · ·
38	Contract liaison	1 1				

None   Some   Exposure   Experience   Proficient   Training				Current Assessment			Have
Tools  36 Quality Function Deployment 37 Linear Programming 38 Simplex method 39 ARENA simulation package 40 WITNESS simulation package 41 PROMODEL simulation package 42 CAD/CAM 43 MICROSOFT PROJECT 44 CPM 45 PERT 46 Trade off analysis 47 Xbar and R charts 48 n.p.c. and u charts 49 Process capability 50 Response Surface Modeling 51 DoD guidelines in production engineering 52 Life Cycle Analysis 53 Flow Charts 54 Affinity Diagrams 55 Fault Tree Analysis 56 Failure Modes and Effects Analysis 57 Pareto Charts 58 Ishikawa Diagram / Fishbone Diagram 59 Matrix Diagram 60 Relations Diagram 61 Systematic Diagram 61 Systematic Diagram 62 Arrow Diagram 63 Process Decision Program Chart 64 MRP or MRP II 65 Design of Experiments / Taguchi Methods			None	Some	Moderate	Very	Had Formal
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Simplex method  ARENA simulation package  WITNESS simulation package  PROMODEL simulation package  CAD/CAM  MICROSOFT PROJECT  CPM  Trade off analysis  Trade off analysis  Nor, and u charts  Process capability  Response Surface Modeling  DoD guidelines in production engineering  Life Cycle Analysis  Affinity Diagrams  Fault Tree Analysis  Failure Modes and Effects Analysis  Fareto Charts  Shikawa Diagram / Fishbone Diagram  Matrix Diagram  Relations Diagram  Arrow Diagram  Relations Diagram  Relations Diagram  Arrow Diagram  Process Decision Program Chart  MER or MRP II  Design of Experiments / Taguchi Methods	36	Quality Function Deployment					
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